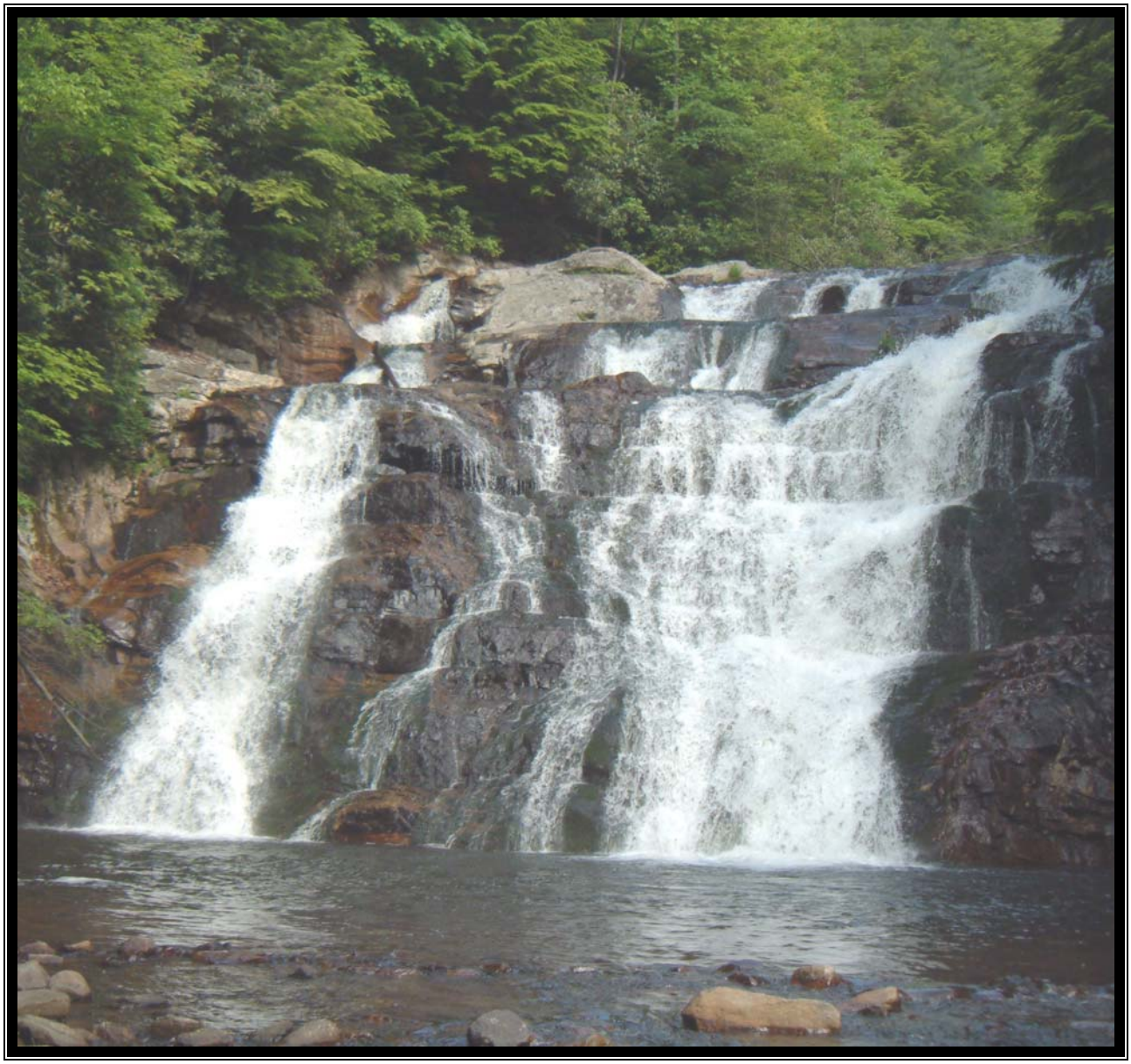
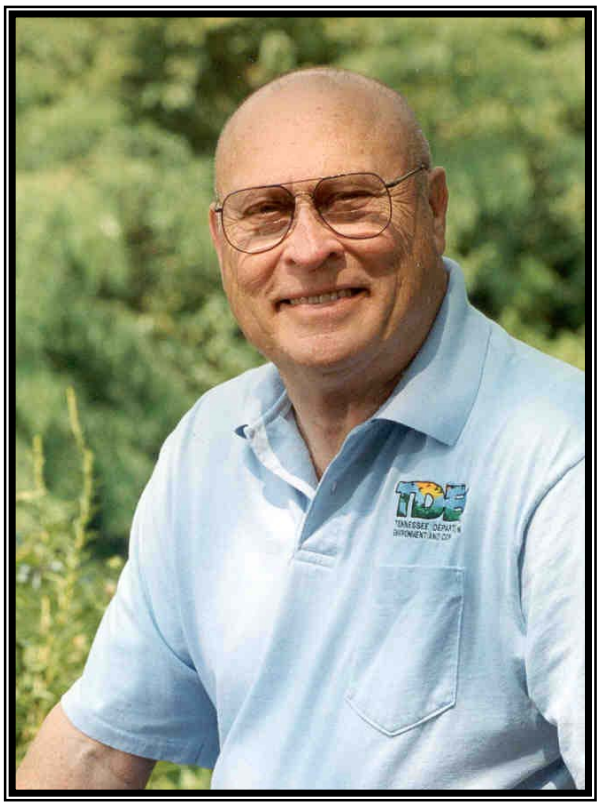
2002 305(b) Report
The Status of Water Quality in Tennessee



Division of Water Pollution Control
Tennessee Department of Environment and Conservation

Message from Commissioner
Milton H. Hamilton, Jr.



As I write this, I am nearing the end of my term as commissioner of the Department of Environment and Conservation. As I look forward to retirement, there is much I'll miss about the job I am leaving. First and foremost, I will miss the daily interaction with the dedicated employees I have had the pleasure of working with during the last five years.

We have many accomplishments to show for our efforts to protect Tennessee's water resources. With the passage of the Inter-basin Transfer Act and our work towards the development of regional approaches to water supplies, we are taking the steps needed to tackle critical water quantity issues. Tennesseans can no longer take for granted that water supplies will be unlimited and inexpensive. Neither can we assume that our friends in neighboring states are not considering how they can help quench their growing thirsts with Tennessee water.

We have restored some important streams. The Pigeon River, while still not as clean as it needs to be, is the cleanest it has been in nearly a century. The 12-year old dioxin advisory on the Pigeon was recently lifted and fish caught there are safe to eat. I was proud to stand with Nashville Mayor Purcell as signs warning against water contact on a large portion of the Cumberland River were recently taken down. The French Broad River and the Ocoee River, both with long-standing water quality issues, now have sections that have been removed from the state's list of impaired waters.

I'm just as proud of the work done by others to improve water quality. Arkansas Creek was once severely impacted by the Williamson County Landfill. Lewis Bumpus and his staff at the landfill decided to do something about it. They improved operations, installed world-class erosion control devices, and brought in biologists to study the creek. The results were dramatic. Aquatic life has returned to the stream and is flourishing. Arkansas Creek has gone from being a liability to an asset.

Being the commissioner of the Department of Environment and Conservation has been one of the highlights of my career. I know that the dedication and professionalism this department has shown during my tenure will continue into the future. Significant challenges remain, including the need to balance the desires of our rapidly growing population with the imperative to preserve Tennessee's abundant natural resources. I am confident the state and people of Tennessee will successfully meet these challenges.

2002 305(b) Report
The Status of Water Quality in Tennessee

prepared by

Gregory M. Denton, Kimberly J. Sparks,
Deborah H. Arnwine, and Linda K. Cartwright

Geo-Indexing of Water Quality Information by

Richard E. Cochran

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Tennessee Department of Environment and Conservation
Division of Water Pollution Control
401 Church Street
L&C Annex, 6th Floor
Nashville, Tennessee 37243-1534
615-532-0699

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I. Acknowledgements

The Planning and Standards Section of the Division of Water Pollution Control produced this report. Director of the Division is Paul E. Davis. Deputy Director is Garland P. Wiggins.

The information compiled in this 2002 water quality assessment document was provided by many state and federal agencies. These agencies include the Tennessee Department of Environment and Conservation, Tennessee Department of Health, Tennessee Valley Authority, U. S. Environmental Protection Agency, Tennessee Wildlife Resources Agency, U. S. Army Corps of Engineers, and the U. S. Geological Survey. The Division is grateful for their assistance and cooperation.

The authors would like to express appreciation to the Water Pollution Control staff of TDEC's regional environmental assistance centers (EACs) and the Aquatic Biology staff of the Tennessee Department of Health (TDH) who collected the stream data documented in this report. The managers of the staff in these offices are:

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Andrew Tolly	Johnson City EAC
Tim Wilder	Columbia EAC
Fran Baker	Cookeville EAC
David Stucki	Aquatic Biology, TDH

Cover photo: Laurel Falls on Laurel Fork in the Cherokee National Forest as seen from the Appalachian Trail. Photo provided by Lee Keck, Division of Water Supply.

II. Executive Summary

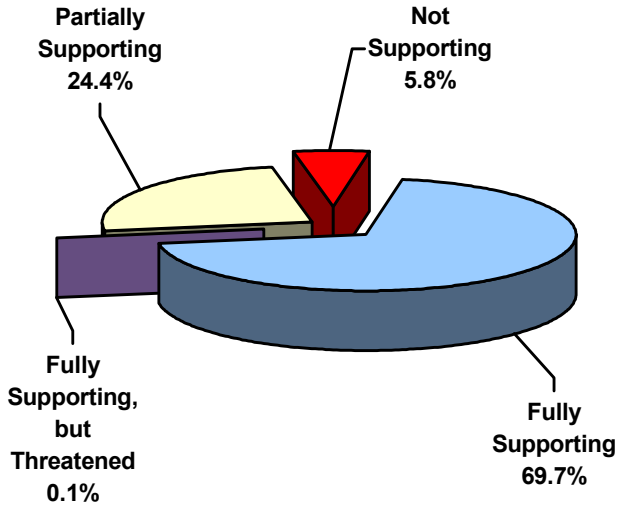
The federal Water Pollution Control Act, Section 305(a) requires a biannual accounting to congress of the water quality in each state. Section 305(b) requires that each state provide a biennial water quality report to EPA. Tennessee's Water Quality Control Act also requires a report of the water quality in each state. Tennessee Department of Environment and Conservation (TDEC), Division of Water Pollution Control has primary responsibility for assessment and reporting of the quality of surface waters.

Assessment Process

The Tennessee Water Quality Control Act requires the protection of water quality and maintenance of the designated uses as defined in our water quality standards. These standards have three components. Use classifications establish seven designated uses of waterways. Criteria identify the level of water quality needed to support each of the designated uses. The antidegradation section protects existing uses of all waters and establishes procedures for authorizing a lowering of water quality.

Water quality data collected across the state are compared to the criteria established for the designated uses assigned to each stream. Streams that meet these criteria are considered to be unpolluted and supporting designated uses.

Water Quality in Streams and Rivers

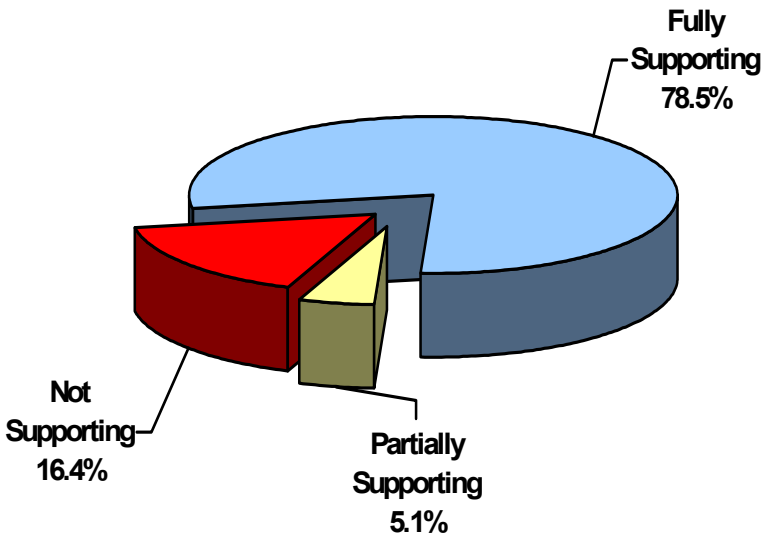


Tennessee has over 60,000 miles of streams and rivers. Almost half of these stream miles have been recently monitored and assessed. EPA defines recent information as data collected in the last five years. Streams without recent data are generally assigned to the category "not assessed." Of the streams that can be assessed, about 70 percent of the stream miles are characterized as fully supporting designated uses.

The remainder of the streams have been assessed as impaired to some degree and therefore, either partially or not supporting some of their uses. Over 24 percent of the stream miles are assessed as partially supporting due to moderate pollution levels. Six percent are considered not supporting due to severe pollution. Figure 1 on page 5 provides an illustration of water quality statewide.

Water Quality in Lakes and Reservoirs

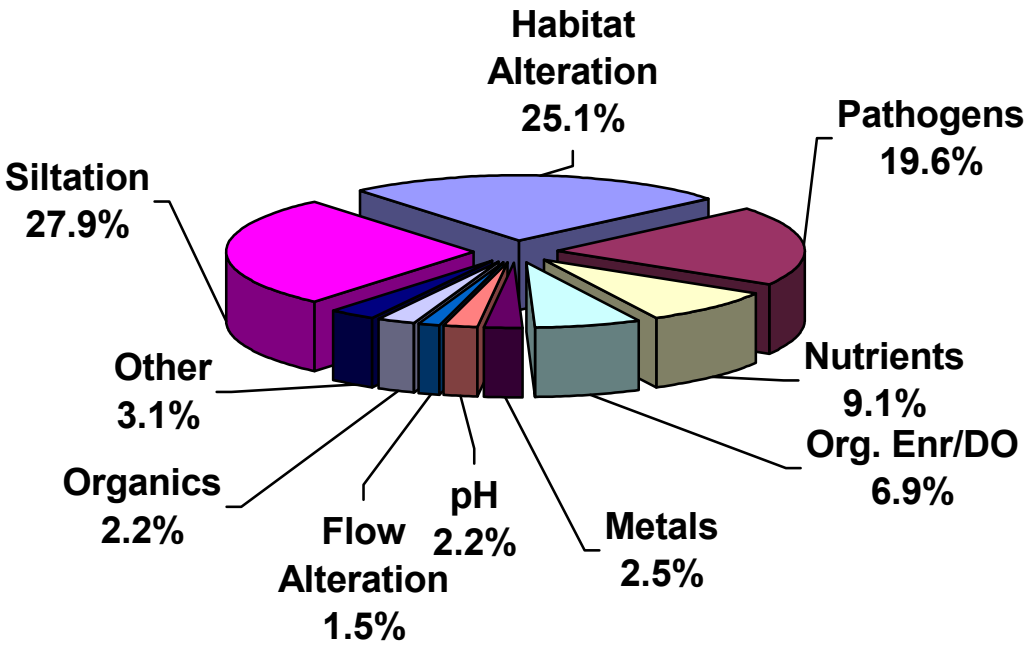
Tennessee has 91 publicly owned reservoirs and a large lake (Reelfoot) that together total 536,724 lake acres. Almost all the large reservoirs and lakes have been recently monitored. Over 78 percent of the lake acres were found to be fully supporting of all uses. Five percent of the lake acres were assessed as partially supporting. About 16 percent of the lake acres are assessed as not supporting designated uses.

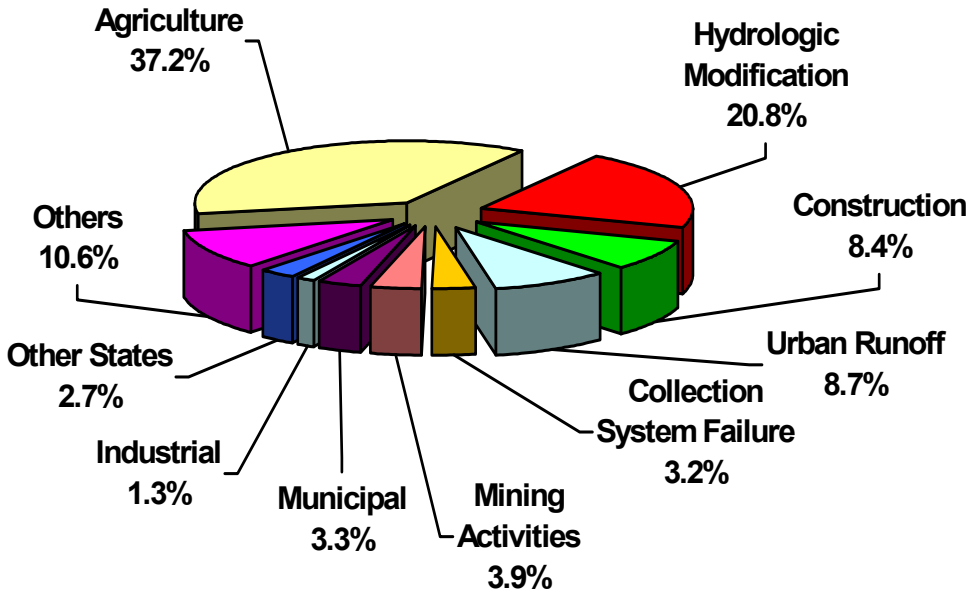


Causes and Sources of Pollution

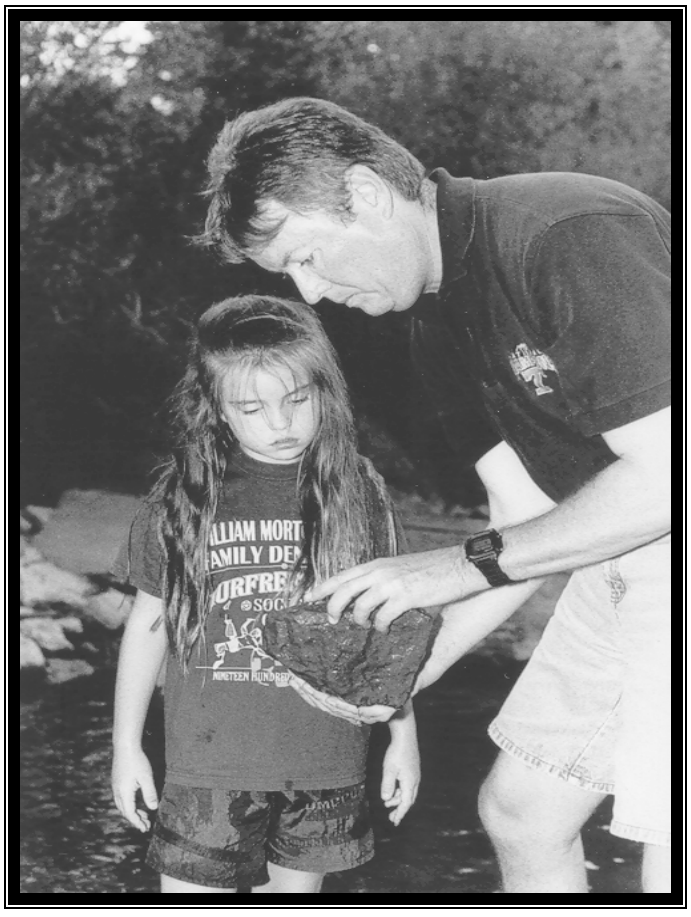
Once it is determined that a stream, river or reservoir is not fully supporting its designated uses it is necessary to figure out what the pollution is (cause) and where it is coming from (source). The most common causes of pollution in rivers and streams are siltation, habitat modification, nutrients and pathogens. Similarly, the main sources of this pollution in rivers and streams are agricultural activities, hydrological modification, construction, and urban sources. The leading causes of pollution in reservoirs are organic substances like PCBs, chlordane and dioxins. The dominant pollution source in reservoirs is the contaminated sediment that contains these substances.

Relative Causes of Impacts in Rivers and Streams





Relative Sources of the Pollutants Causing Impacts in Rivers and Streams



One of the Division's experienced biologists explains the nuances of benthic macroinvertebrate taxonomy to an elementary school student.

Innovative Programs

TDEC, in partnership with numerous agencies and groups, has developed several innovative programs and projects to assist in the management, protection, and restoration of the state's water resources.

The watershed program provides a systematic approach to the water quality monitoring, assessment, permitting, and stream restoration efforts of the department. The Division continues to meet all TMDL development goals.

The ecoregion project divided the state into similar areas called subecoregions. Reference streams were identified and intensively monitored in each area to provide information about the background quality of streams in that region.

Additionally, TDEC is testing new ways to monitor water quality. In the probabilistic monitoring project, the Division is experimenting with randomly selecting sampling stations rather than doing what is commonly referred to as "targeted" monitoring. If this experiment proves successful, a more widespread application of this approach will be considered.

Tennessee Water Quality Summary 2002

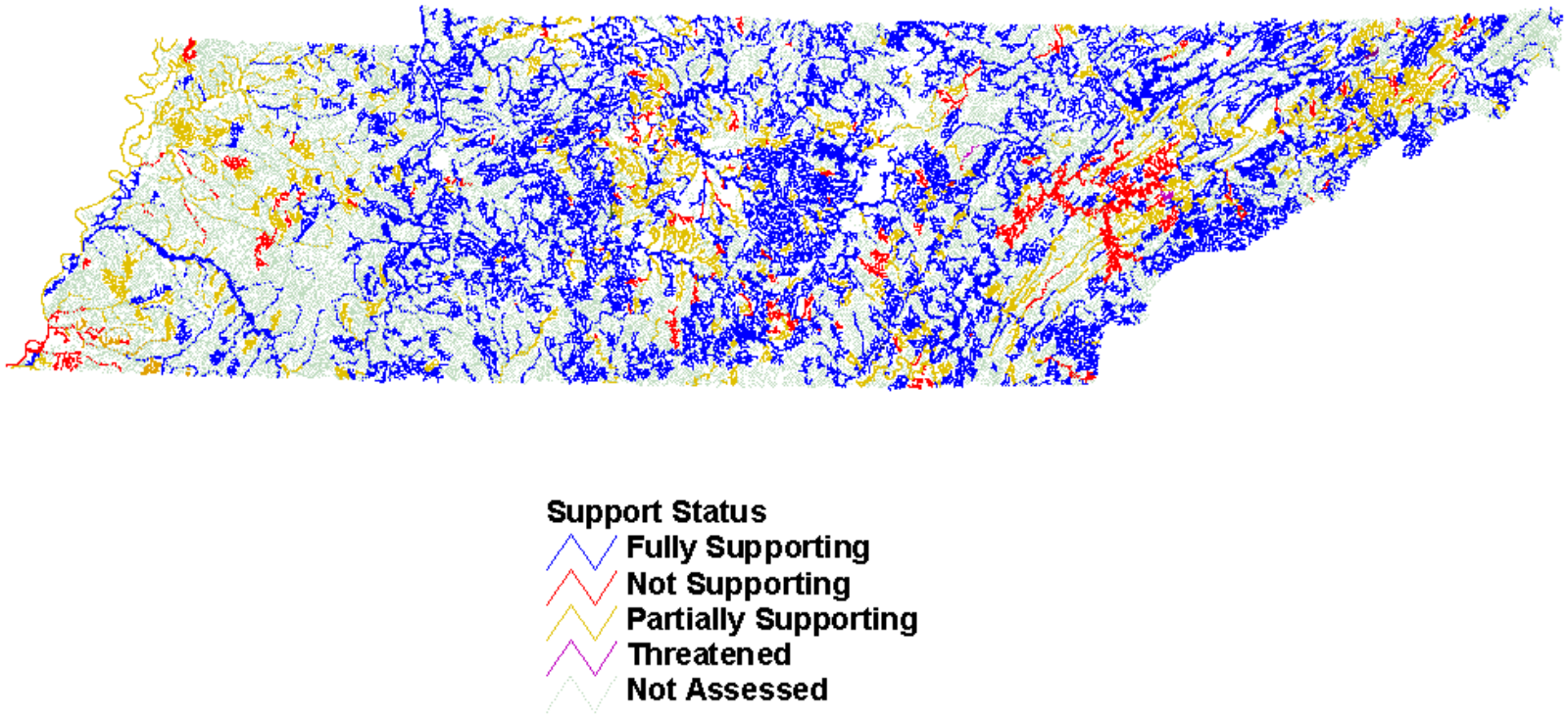


Figure 1: Tennessee Water Quality Summary 2002

III. Definitions and Acronyms

Definitions

Benthic Community: Animals living on the bottom of the stream.

Biocriteria: Numerical values or narrative expressions that describe the reference biological condition of aquatic communities inhabiting water of a given designated aquatic life use. Biocriteria are benchmarks for water resources evaluation and management decisions.

Biometeric: A calculated value representing some aspect of the biological population's structure, function or other measurable characteristic that changes in a predictable way with increased human influence.

Bioregion: An ecological subregion, or group of ecological subregions, with similar aquatic macroinvertebrate communities that have been grouped for assessment purposes. Tennessee has defined 15 bioregions.

Ecoregion: A relatively homogenous area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, and other ecologically relevant variables. There are eight (Level III) ecoregions in Tennessee.

Ecological Subregion (or subecoregion): A smaller area that has been delineated within an ecoregion that has even more homogenous characteristics than does the original ecoregion. There are currently 25 (Level IV) ecological subregions in Tennessee. (Delineation of subecoregions in neighboring states has indicated that three additional subregions may need to be added to this total.)

Ecoregion Reference: Least impacted, yet representative, waters within an ecoregion that have been monitored to establish a baseline to which alteration of other waters can be compared.

Habitat: The instream and riparian features that influence the structure and function of the aquatic community in a stream.

Macroinvertebrate: Animals without backbones that are large enough to be seen by the unaided eye and which can be retained by a U.S. Standard No. 30 sieve (28 meshes/inch, 0.595 mm).

Pathogens: Disease causing micro-organisms.

Regulated Sources: Pollution originating from sources governed by state or federal permitting requirements. These sources are typically from discrete conveyances, but also include stream alterations, urban runoff, and stormwater runoff from construction sites.

Definitions Continued

Non-Regulated Sources: Activities exempted from state or federal permitting requirements. In Tennessee, these sources are agricultural and forestry activities which utilize appropriate management practices. Additionally, sources such as atmospheric deposition might be considered unregulated sources, since they are not controllable through the water program.

Riparian Zone: An area that borders a waterbody.

Water Pollution: Alteration of the biological, physical, chemical, bacteriological or radiological properties of water resulting in loss of use support.

Watershed: A geographic area which drains to a common outlet, such as a point on a larger lake, underlying aquifer, estuary, wetland or ocean.

Acronyms

ADB: Assessment Database

EAC: Environmental Assistance Center

EPA: United States Environmental Protection Agency

EPT: Ephemeroptera (Mayflies) Plecoptera (Stoneflies) Trichoptera (Caddisflies)

GIS: Geographic Information System

GPS: Global Positioning System

HUC: Hydrological Unit Code (Watershed Code)

ONRW: Outstanding Natural Resource Water

OSM: Office of Surface Mining

PAS: Planning and Standards Section

RIT: Reach Indexing Tools

STORET: EPA's STOrage and RETrieval Database

TDEC: Tennessee Department of Environment and Conservation

TDA: Tennessee Department of Agriculture

TDH: Tennessee Department of Health

TMDL: Total Maximum Daily Load

TVA: Tennessee Valley Authority

TWRA: Tennessee Wildlife Resource Agency

USACE: U.S. Army Corps of Engineers

USGS: U.S. Geological Survey

USFWS: U.S. Fish and Wildlife Service

WPC: Water Pollution Control

IV. Introduction

According to the federal Water Pollution Control Act, commonly called the Clean Water Act, each state is required to assess water quality and report the results to Congress and the public biannually. Section 305(b) of the original law passed in 1977 required a biannual description and analysis of each state's waterways. In addition to the federal requirements, the state's Water Quality Control Act of 1977 requires the Division of Water Pollution Control to produce a technical report on the status of water quality in Tennessee. This report serves the requirements of both the federal and state laws.

Both federal and state water quality laws require that emphasis be placed on identifying and restoring impacted waters. The assessment of streams, lakes, and reservoirs requires recently collected, high quality information. To facilitate both of these goals the state has adopted two methods, which work in parallel. One is an organizational framework called the watershed management approach, which coordinates watershed monitoring, assessments, and public participation. The other is the ecoregion approach that helps establish reasonable water quality expectations in different geological ecoregions of the state. Monitoring the best obtainable yet representative streams in each area identifies these regional water quality goals.

TDEC goals for the 305(b) Report are:

- Assess the general water quality conditions of rivers, streams, lakes, and wetlands.
- Identify the causes and sources of water pollution.
- Specify waters that pose human-health risks due to elevated bacteria levels or contamination of fish.
- Highlight areas of improved water quality.

In order to establish a background for understanding water pollution, the 305(b) Report is organized from general information to very specific data. Chapter VI provides an overview of water quality statewide and takes a closer look at conditions in west, middle, and east Tennessee. Information specific to each watershed is detailed starting on page 114.

This report is only on surface waters in Tennessee. The Department's Division of Water Supply has prepared a report on ground water quality entitled "*Tennessee Ground Water 305(b) Water Quality Report*." For a copy of this report or information regarding the quality of ground water and water supply issues in Tennessee, please contact the Division of Water Supply at (615) 532-0191.

A. Cost of Water Pollution

It may not be possible to place a dollar value on the cost of water pollution. Everyone is affected by it and has a vested interest in improving water quality. There may be costs of water pollution that have yet to be realized.

Two of the most obvious costs from water pollution are the expense of health care and loss of productivity while people are ill. When untreated or inadequately treated human or animal wastes are in the water they can expose people to any number of pathogens (disease causing organisms). Another health risk is from eating contaminated fish that can increase cancer risk and other health problems especially in children and pregnant women. Both of these risks are further discussed in Chapter IX.

The community loses an important resource when the water is no longer safe for recreational activities. Commercial fisherman lose income when it is no longer safe to sell fish. Subsistence fishermen are faced with the loss of their primary protein source.

Commercial navigation as a means to move goods and services around the country is one of the most economical methods of transportation. As channels fill with sediment from upland erosion, commercial navigation becomes less practical. Siltation also reduces the useful lifespans of lakes and reservoirs.

B. Other Water Quality Assessment Reports by the Division

Another provision in the federal Water Pollution Control Act is a requirement for a biannual document listing Tennessee's streams, rivers, and reservoirs that do not meet established standards. Like the 305(b) Report, the 303(d) List is titled after the section of the federal Water Pollution Control Act that required the report.

Once a stream has been placed on the 303(d) List it is considered a priority for water quality improvement efforts. Enforcement activities, TMDL development, and permits are all targeted toward improving water quality.

For additional information concerning water quality issues:

please contact staff at: (615) 532-0699

or

e-mail Gregory.Denton@state.tn.us.

or

Visit the department's home page at
http://www.state.tn.us/environment

How Is This 305(b) Report Different From the Previous Ones?

A 305(b) Report is a summary of the water quality information that is accumulated in any reporting period. Both the quantity and quality of the information gathered varies dramatically by reporting cycle. This variation is due, in part, to changes in sampling intensity, methodology, and priority. For these reasons, the 305(b) Report is not considered to be a reliable indicator of water quality trends throughout the state. It is instead, a snap-shot in time of the conditions existing at the time it was drafted.

The 2002 305(b) Report is, however, considered an improvement over previous versions for several reasons.

Increased Coverage. In 1996, the division began the watershed approach, a significant departure from how assessments had been done in the past. Instead of attempting to maintain a statewide coverage of monitoring stations in order to generate assessment reports, we began concentrating efforts into specific watersheds each year based on a prearranged schedule.

In the previous 305(b) generated in 2000, we had intensively studied watershed Groups 1, 2 and 3. By 2001, we had completed intensive monitoring in the rest of the watershed groups and had statewide assessment coverage. Additionally, we were much more successful in obtaining water quality information from other agencies, making the 2002 303(b) Report the most comprehensive water quality inventory ever accomplished in Tennessee.

More Precision. In previous reports, the division lacked the ability to segment waterbodies into smaller sections. As a result, large watersheds containing significant numbers of stream miles were frequently lumped together. While this approach was necessary at the time, EPA's Assessment Database and Reach Indexing Tool software, plus new powerful computers and databases, have allowed existing waterbodies to be segmented into an almost infinite number of sections. Each section can have its own identifier and assessment information.

When these tools are combined with more comprehensive monitoring under the watershed approach, we can provide the type of precision necessary to more accurately document water quality status, facilitate development of control strategies, and measure progress towards clean water goals. In 1996, the Division identified approximately 850 individual stream segments. In 2002, these existing waterbodies have been divided into over 4,000 segments.

C. Ecoregions

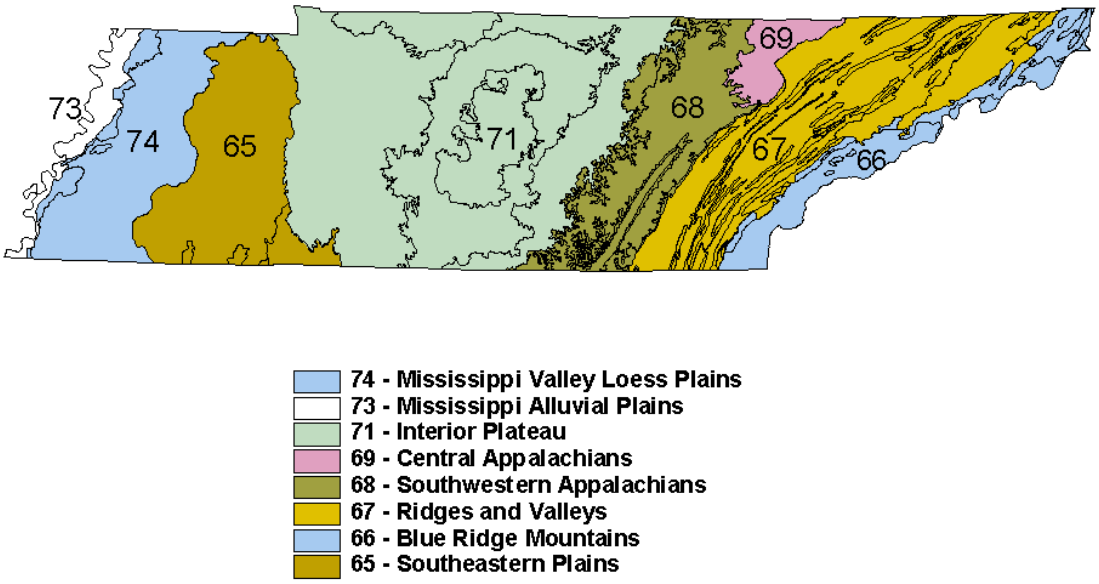


Figure 2: Level III Ecoregions of Tennessee.

In order to understand how geology, soil, land use, vegetation and other regional aspects affect stream biological health and water quality, a regional approach proposed by EPA has been adopted by the state. Initiated in 1994, a joint effort between federal and state agencies delineated eight distinctive geological regions called Level III ecoregions (Figure 2). These ecoregions were further subdivided into 25 Level IV subecoregions.

An ecoregion is a relatively homogeneous area defined by similarity of climate, landform, soil, potential natural vegetation, hydrology, and other ecologically relevant variables.

Within each of these 25 Level IV subecoregions, the least impacted yet representative streams were chosen to serve as reference streams. These subecoregion reference streams have been monitored since 1996 to establish reasonable chemical and biological expectations for different regions of the state. The ecoregion approach is further discussed in Chapter XI.

From the information gathered from the chemical and biological sampling, it has been possible to further refine water use criteria. New subecoregion criteria have been proposed for biological, nutrient, pH and dissolved oxygen criteria. These proposed criteria changes are further discussed in Chapter XII.

D. Watersheds

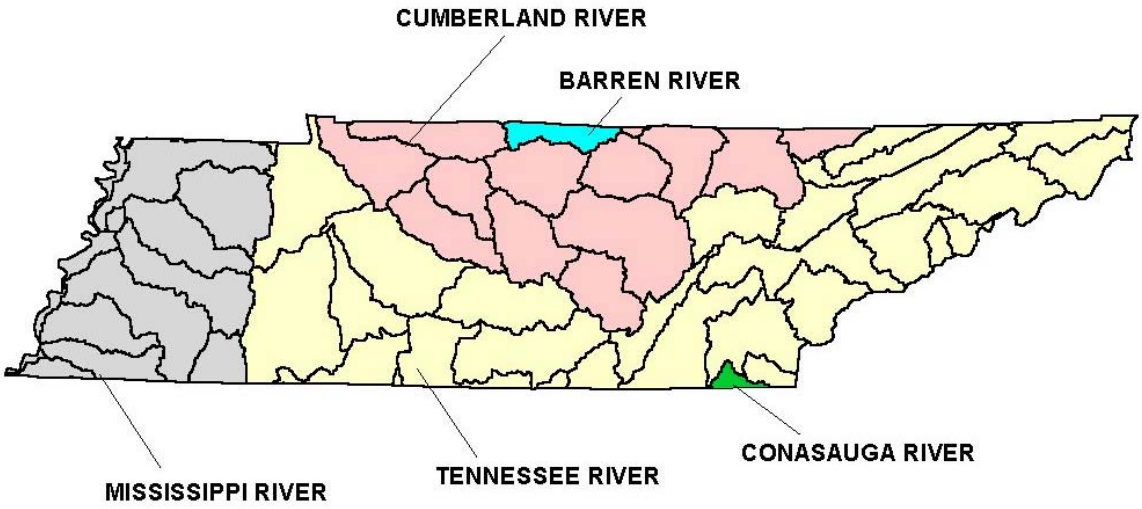


Figure 3: Tennessee's Major Basins and Smaller Watersheds.

Ecoregions serve as a geographical framework for establishing water quality expectations. The watershed approach is an organizational framework for systematic monitoring to define the state's water quality problems. The entire area that drains into a river or reservoir is called a watershed.

A watershed is a geographic area that drains to a common outlet.

The Division has developed a unified process for identification of water quality problems called the watershed approach. Tennessee includes five main river systems. Three of these, the Cumberland, the Mississippi, and the Tennessee Rivers, drain most of the state's water. These main systems have been further subdivided by USGS into 54 watersheds (Figure 3). The 54 watersheds have been divided into five groups for assessment purposes. Each year, the five watershed groups are in a different phase of the watershed cycle. This approach to water quality management provides for coordinated action with the public and other agencies.

The cycle begins with planning and data collection for the appropriate watershed group in the first year. In the second year of the cycle, the streams are monitored and in the third year they are assessed. In the fourth year wasteload allocations are determined and in the fifth year permits are issued. In this way different agencies and the public are coordinated in their efforts to improve water quality. Every year each of the five watershed groups is in a different phase of the watershed cycle. In this way each watershed is thoroughly assessed every five years. The watershed approach is further discussed in Chapter XIII.

Tennessee State Atlas

State population (2000 Census)……5,689,283
Largest Cities (2000 Census)
Memphis…….650,100
Nashville…….545,524
Knoxville……173,890
Chattanooga……155,554
Clarksville……...103,455
Murfreesboro……68,816
Jackson……..59,643
Johnson City…….55,469

Number of Counties……95
State Surface Area (square miles)……42,244

Number of Major Basins……13
Number of Level III Ecoregions……....8
Number of Level IV Ecoregions…….25
Number of Watersheds……54
Number of Stream Miles Forming State Border……213
(The Mississippi River forms most, but not all,
of these miles shared another state.)
Stream Miles Statewide (Reachfile 3)……..60,226

Largest Rivers at Low Flow (7Q10 in ft^3/sec.)
Mississippi River at Memphis……..109,000
Tennessee River at South Pittsburg……12,500
Cumberland River at Dover……2,280
Hiwassee River at Charleston…….1,150
French Broad River near Newport……533
Obion River at Menglewood…….357
Hatchie River at Rialto……..309
Duck River near Only……303

Publicly-owned Lake Acres Statewide……...536,794

Largest Lakes (size in acres)
Kentucky Reservoir (Tennessee portion)……117,500
Watts Bar Reservoir ……..39,000
Barkley Reservoir (Tennessee portion)…….37,000
Chickamauga Reservoir…….35,400

Estimated Acres of Wetlands……...787,000